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development of agricultural chemistry. Further, in the early years of the Sheffield Scientific School he was a pillar of strength, an example of the highest type of productive scholar, and a forceful illustration of the power which a scientific man can wield for the good of the community. The life of Samuel William Johnson and the work he accomplished constitute a suggestive example of a form of high public service which the man of scientific training can render his country and humanity.

Russell H. Chittenden.

WILLIAM THOMSON, LORD KELVIN (1824–1907)

Foreign Honorary Member in Class I, Section 4, 1872.

William Thomson was born in Belfast, Ireland, on June 26th, 1824. He was knighted in 1866 and was raised to the peerage in 1892 with the title of Baron Kelvin of Largs. His ancestors had migrated from Scotland in the seventeenth century. His father, James Thomson, removed from Belfast with his family to Glasgow, Scotland in 1832 to occupy the chair of Mathematics at Glasgow University. William matriculated at that institution in 1834, being then a little over ten years old. He was a precocious boy, rapidly advancing in his studies and early giving promise of that great mathematical genius and grasp of scientific problems, which especially characterized his later life. At sixteen he had, as a voluntary task, mastered Fourier's methods and theorems in the original French, this study occupying a fortnight only. He graduated from Cambridge University in 1845 taking rank as second wrangler, and shortly afterwards became Smith's Prizeman. Many evidences of his special talents were shown during his student years at Cambridge, in papers and discussions.

Leaving Cambridge he studied in Paris and there came into contact with such leaders as Pouillet, Regnault, Liouville, Biot, Cauchy, Foucalt, Dumas, Pelouze and others.

In 1845 he was granted a Fellowship with rooms at Cambridge. He had early shown a deep interest in electrical problems and theories, in which field he afterward found opportunity to do his most important work. This interest brought him into contact with Faraday. The so called Kerr effect, which on Thomson's suggestion was sought for unsuccessfully by Faraday was not actually discovered till 1876.

In 1846 Thomson, then only 22, was appointed to the Chair of Natural Philosophy in the University of Glasgow. This position he held for fifty years. There now began a most active period of his life and many of his students afterward became noted in physical science.

Thomson's studies covered the widest range including Kinematics and Thermodynamics. Important discoveries, such as the Thomson thermoelectric effect were made, and inventions of the greatest scientific and technical value worked out. Among these latter may be mentioned the famous mirror galvanometer, of exceeding sensibility and almost essential to ocean telegraphy. There was also the well known water dropper leading to the so called Mouse Mill Replenisher. His great invention of the siphon recorder for cable telegraphy was made in 1869, and later his improved deep sea sounding apparatus and his mariner's compass improvements, aided greatly the art of navigation, in which he had always possessed a keen interest. The briefest record of his great activity in various fields is permissible here.

In 1851, elected to the Royal Society, his papers on Thermodynamics brought him into contact with Helmholtz, Joule and later Clerk Maxwell. It happened that a few years prior to 1858, Thomson had made a study of the conditions of transmission of signals in long submarine cables, using the Fourier mathematics to determine the factors of retardation, etc. In 1858 the first Atlantic Cable was laid, and for a time it was successful; failing after several hundred messages had been transmitted. Such success as there was must be attributed to Thomson, and the failure was probably caused by faults of insulation made worse by allowing the cable to be manipulated at high voltages and under conditions directly at variance with Thomson's ideas and disapproved by him.

The great treatise by Thomson and Tait on Natural Philosophy was projected about this time. Part I however was not published until 1879 and Part II not until 1883. The authors thereafter abandoned the publication of the originally contemplated two additional volumes.

Following the London International Exhibition, Thomson took an active part in the committee work in 1862 involving the establishment of values and names for the international electrical units, such as the ohm, the volt and the farad. This pioneer work has been continued at the later international congresses and conferences, several of which he attended.

The task of again laying an Atlantic Cable was taken up in 1865 with Thomson as the responsible electrical head. As is well known the 1865 cable broke in mid-ocean necessitating a new cable. This was laid in 1866 under Thomson's careful supervision aboard ship, and with constant tests as to the integrity of the cable being paid out. The result was completely successful and was at once followed by the picking up at sea, the splicing and completion of the broken 1865 cable; thus rendering available two cables instead of one. It was characteristic that Thomson had previously renounced any claim for time or services or even expenses, unless success was obtained. It was this success which earned him his Knighthood. His attention had not, however, been turned away from his purely scientific work. His papers on the age of the sun's heat and on the secular cooling of the Earth, brought on the famous controversy with the naturalists, principally the biologists and geologists; a controversy which was continued until at last the discovery of radio-activity had introduced new, and before unknown, factors, which had not entered into his calculations, and which virtually destroyed their applicability to the case. His studies on the rigidity of the Earth did much to negative the old assumption of a fluid interior supporting a solid crust. His papers dealing with his vortex theory of atoms, and papers and addresses on the ether of space were not the less noteworthy, though the views advanced he later renounced. In spite of his firm belief in the doctrines of creation and design in nature, he was not prevented from suggesting that the first germs of life on the earth might have been brought by a meteor from the outside. His practical judgment caused him to realize at once the great value of Bell's telephone in 1876, he being a first witness of its performance at the Centennial Exhibition. His appreciation of the future great service to be expected from the larger electrical applications was another evidence of his exceptional practical insight. This is exemplified in a strikingly prophetic statement made by him on Jan. 22, 1878, before the Institution of Civil Engineers of Great Britain.

Later Sir William Thomson contributed markedly to the art of exact electrical measurements in large work by his inventions of electrostatic voltmeters and particularly by his electrodynamic balances, now known as Kelvin balances. He was author of the article on Electricity and also the four principal sections on Heat in the ninth edition of the Encyclopoedia Brittanica.

Among many subjects investigated mathematically and experimentally by him were gyrostatics and wave motions, on which he became an authority.

Sir William was raised to the peerage in 1892 and was afterward known as Lord Kelvin. His retirement from his professorship in the University took place in 1896 and was the occasion of a jubilee in his honor after fifty years of service. In this celebration many of the foremost scientific men of the time took part.

He died Dec. 17, 1907, and his remains now rest in Westminster Abbey, next to the grave of Isaac Newton. A memorial window was later placed in the Abbey in commemoration of his life and work. He was twice married, but there were no children. In him were united the greatest gifts, a mathematical ability of the highest order, a deep scientific interest, an originality and industry most exceptional, and a personality most modest and attractive. His great talents were exercised not only in pure science, but were brought to bear with equal fruitfulness on difficult practical problems, and led to the conception and development by him of many valuable inventions, to some of which allusion has been made in the foregoing brief account of his life.

ELIHU THOMSON.

HENRY CHARLES LEA (1825-1909)

Fellow in Class III, Section 3, 1870.

Henry Charles Lea, son of Isaac Lea and grandson of Mathew Carey, was born in Philadelphia in 1825 and died there 24 October 1909. Of precocious ability, he was educated at home and by private tutors, and at the age of eighteen entered his father's publishing house, with which he remained actively connected until 1880. He took an active part in the business and political life of his city and in public matters generally, but his dominant interests were those of a scholar and man of letters, manifested first in literary and scientific studies printed in his early youth, and later in the monumental series of books on mediaeval law and ecclesiastical history and institutions which began to flow from his pen in 1866. The eighteen solid volumes of his published works of history comprise: "Superstition and Force" (1866, fourth edition, 1892); "History of Sacerdotal Celibacy" (1867, enlarged edition, 1907); "Studies in Church History" (1869); "History of the Inquisition of the Middle Ages" (1888; also in a